

GENERATIVE AI

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EXECUTIVE SUMMARY

Artificial intelligence (AI) continues to have a transformative impact on various industries, being widely adopted for applications like fraud detection and process automation. However, the spotlight is now on Generative AI, a machine learning subfield focused on creating novel outputs, which has been propelled by advancements in natural language processing and the development of large-scale, pre-trained language models. Major AI companies, such as OpenAI, have released these powerful models for public use, leading to a surge in AI adoption across various sectors.

This report explores real-world applications of Generative AI and its potential implications by leveraging the expertise of Reply Group companies and their experiences across diverse industries. The study concentrates on key Reply markets and estimates market size evolution from 2022 to 2027, in collaboration with PAC, for two clusters: Big-6 (Germany, USA,

UK, France, China, India) and Rising-6 (Italy, Brazil, Belgium, Poland, Romania, and the Netherlands).

Generative AI is predicted to experience growth in all countries, with varying growth rates and impact levels by 2027 in relation to total AI investments. These are expected to increase in all the countries over the next five years, with Generative AI emerging as a rapidly growing niche, accounting for 12% of total investments in 2027. In the Big-6 cluster, Generative AI's share will expand from less than 1% of a €36 billion market in 2022 to over 12% of an almost €100 billion market in 2027. Concurrently, in the Rising-6 cluster, both the overall AI market and the Generative AI segment will witness significant growth, with the latter representing about 7% of the total €3.7 billion AI investments in 2027.

Generative AI is expanding beyond text generation to include image, audio, and video content creation. User-friendly tools like ChatGPT and Midjourney leverage Generative AI to quickly generate high-quality content for various communication channels. Market growth is fuelled by increased computing power and the integration of large language models into products and services. Companies are increasingly developing trillion-parameter models, which require substantial investments in computing costs.

Several industries are being revolutionized by Generative AI, particularly in fields such as copywriting, content-editing, and image sourcing. By utilizing large language models, the technology enables rapid multilingual content generation, streamlining processes while maintaining contextual relevance and translation quality. In image sourcing, Generative AI is used for unique image creation and swift customization, boosting creativity and efficiency.



As text generation models progress, they will produce higher-quality outputs and better industry-specific tuning. Generative AI is expected to permeate various industries, improving the work of knowledge workers by automating time-consuming tasks. Notable advancements have also been made in speech synthesis, with further improvements anticipated in the near future.

Therefore, Generative AI is also being harnessed to enhance digital assistants and chatbots, resulting in more natural and empathetic conversations with AI-powered avatars. These “digital humans” interact with customers more effectively than traditional chatbots and can be employed in immersive contexts, providing an improved customer service experience.

AI-powered tools also assist in software development with tasks such as writing user stories, editing and reviewing code, detecting bugs, and testing software. These tools contribute to more efficient workflows, increased productivity, and faster time-to-market. The primary advantage of AI is its ability to boost efficiency, enabling developers to focus on more valuable tasks and achieve better results. Some applications of Generative AI include text-to-code generation, code auto-completion, and code summarisation or explanation.

The prevailing emphasis in the Generative AI market on generating textual and multimedia content highlights the extensive adoption of specialized applications across industries like fashion, media, and publishing. Nonetheless, Generative AI also demonstrates immense promise in enhancing processes within sectors such as healthcare, pharmaceuticals, and cybersecurity, where advanced artificial intelligence and machine learning methodologies are presently being effectively utilized.

According to PAC analysts, successful implementation of Generative AI projects requires securing the appropriate level of

buy-in, focusing on business outcomes, and starting small while considering scalability and integration. Cooperation between business and ICT departments, involving end-users in the design process, and paying attention to intellectual property issues are all essential. Ensuring data availability and quality, as well as prioritizing security and compliance, are critical to the success of Generative AI projects.

Generative AI presents a myriad of opportunities while concurrently introducing considerable challenges, necessitating a profound comprehension of its restrictions and implications for ethical deployment. It is vital to address biases in training data to avoid offensive, biased, or damaging content. Although synthetic data may offer advantages like improved privacy and cost reduction, it could fall short in representing real-world complexities, thus prompting concerns about the accuracy and adaptability of AI models.

Legal concerns, such as copyright and data implications, arise from AI’s widespread adoption across industries. Deepfakes generated through AI, for example, pose a threat to accurate information dissemination and can be exploited for political manipulation. The increasing capabilities of AI models also carry the potential for malicious use and cyber attacks. Establishing ethical guidelines and legal frameworks is essential to mitigating these risks and ensuring responsible AI deployment.

The growing integration of AI tools and services could exacerbate energy demands and carbon emissions for technology companies. As AI becomes more prevalent and requires larger datasets, substantial computing power and data centres are necessary, driving high energy consumption and carbon emissions. Developing environmentally responsible solutions is vital in addressing the energy and emissions impacts of AI model training and implementation.



The transformative potential of Generative AI technology is evident for individuals, businesses, and society. Its rapid advancement can democratize different industries and reshape content creation and creative processes. However, businesses must exercise caution and prioritize human leadership when integrating Generative AI into their operations. Addressing the societal, economic, and environmental impacts of Generative AI calls for investments in staff training, development of ethical frameworks, and regulatory implementation. As Generative AI continues to evolve towards General AI, it is crucial to harness its potential responsibly and sustainably, enhancing efficiency and productivity across personal and corporate domains.



Why Has Generative AI Become So Popular?

“

Over the course of the next 10 years, I hope through new chips, new interconnects, new systems, new operating systems, new distributed computing algorithms and new AI algorithms and working with developers coming up with new models, I believe we're going to accelerate AI by another million times

”

Jensen Huang, CEO at Nvidia [Laird, 2023]



A solid innovation process, not a fad

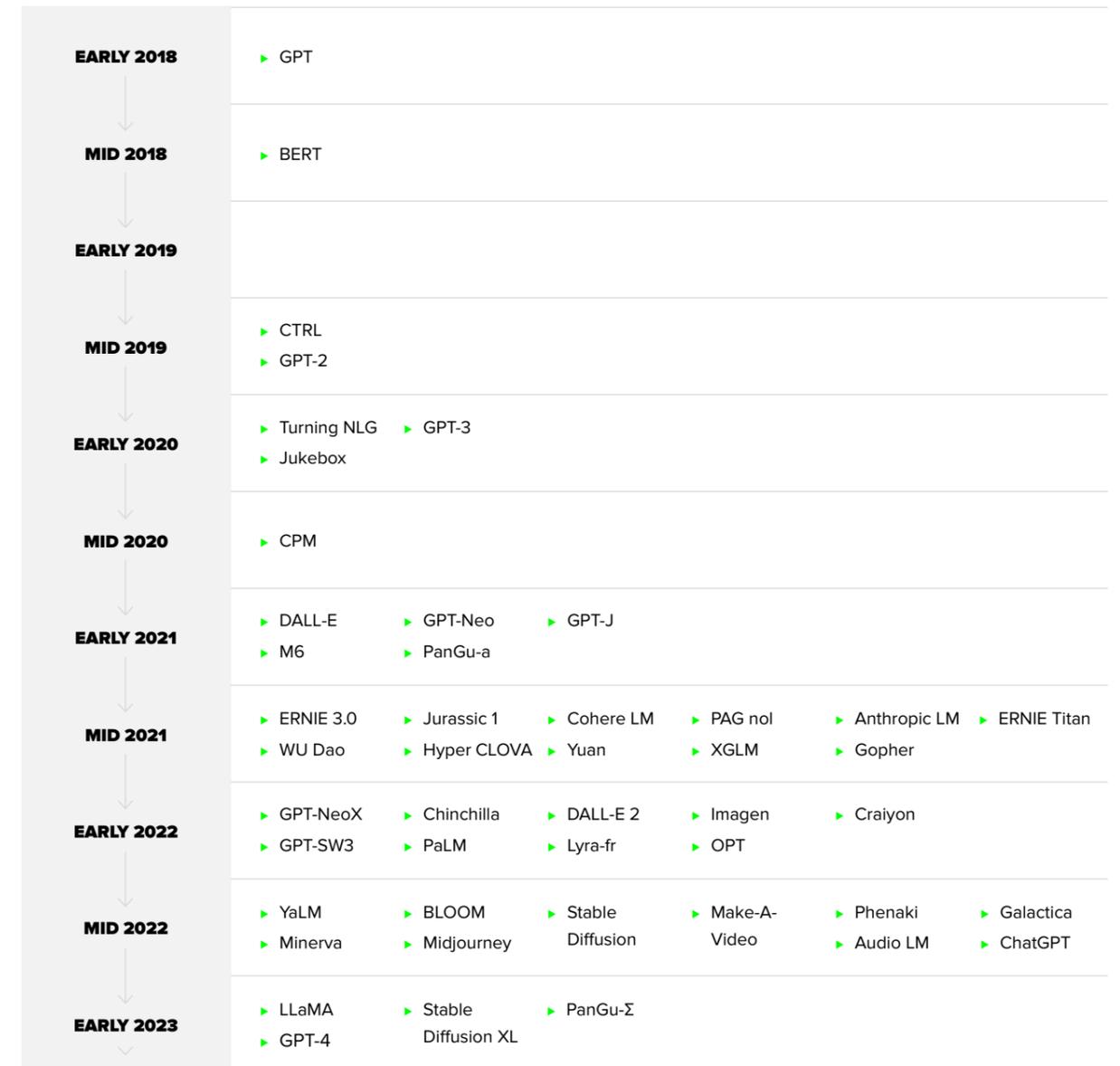
In recent years, numerous artificial intelligence fields, including Discriminative AI, have gained traction across various industries for applications such as fraud detection, intelligent process automation, image classification, sentiment analysis, and recommendation systems. The adoption of AI in operations and businesses is forecast to continue growing noticeably, with a consistent increase in reliability and industry applications.

Today, we see an enormous spotlight on a subfield of machine learning that focuses on systems capable of producing novel and meaningful outputs by learning from large amounts of data. This is Generative AI, a type of artificial intelligence trained to generate new and creative outputs instead of performing predefined tasks or analysing existing data. Both Generative and Discriminative AI have their advantages, and they can be used in combination.

Originating with the development of pioneering models such as Generative Adversarial Networks and Variational Autoencoders ten years ago, researchers have made significant strides in refining these generative models to produce more realistic and high-quality outputs, especially regarding image creation. Today, the development of large-scale, pre-trained language models has revolutionized the field of natural language processing (NLP) and has led to significant advancements in Generative AI, with a particularly relevant focus on languages and texts.

Public release of Generative AI Models in the last 5 years

Source: Reply elaboration based on [Solaiman, 2023]



High expectations towards it come from the faster release of powerful models that were previously only evolving in laboratories but are now available for public use, and having a positive impact on collecting feedback from consumer and enterprise users. Besides major vendors like Google, Microsoft, and Meta, a new class of worldwide leaders like OpenAI, DeepMind, and Stability AI are releasing models powered by billions of parameters and huge open or proprietary databases.



While in previous years models like OpenAI’s Generative Pre-Trained Transformer (GPT) family have mainly been used to automatically generate texts, now consumers and creative professionals started to harness Generative AI’s potential to create images, audio, presentations, videos, and other content, by simply typing a few words into a text box, the so-called “prompt”, in applications like the popular Dall-E 2, Midjourney, or Stable Diffusion.

This simple user experience has created a virtuous cycle of hype, accelerating the go-live of new models and applications based on them. Moreover, the success of these models is also due to the quality and increased reliability of results. Both consumers and professionals receive high-quality texts, translations, synthetic speech, audio, and video content with little or no need for rework before publishing on personal, B2C, and B2B communication channels.

Another relevant reason for the market acceleration is the increased availability of computing power, since Generative AI requires large amounts of data to learn from, and powerful hardware to train and run the models. As for the language models, now the race is on for trillion parameter models: to train such large language models (LLM) requires huge investments in computing costs alone, so only a few leading companies are currently able to afford them. Other companies can leverage these trained models via APIs for specific proposes, e.g., to build Generative AI-powered specialised digital humans.

Further momentum is being built by major technology companies integrating large language models and natural language processing into their products and services, often achieved by partnering with new market leaders and former research labs. Both of the latter are creating new business models where access to Generative AI can be easily gained through API, or with pre-paid buckets and monthly subscriptions.

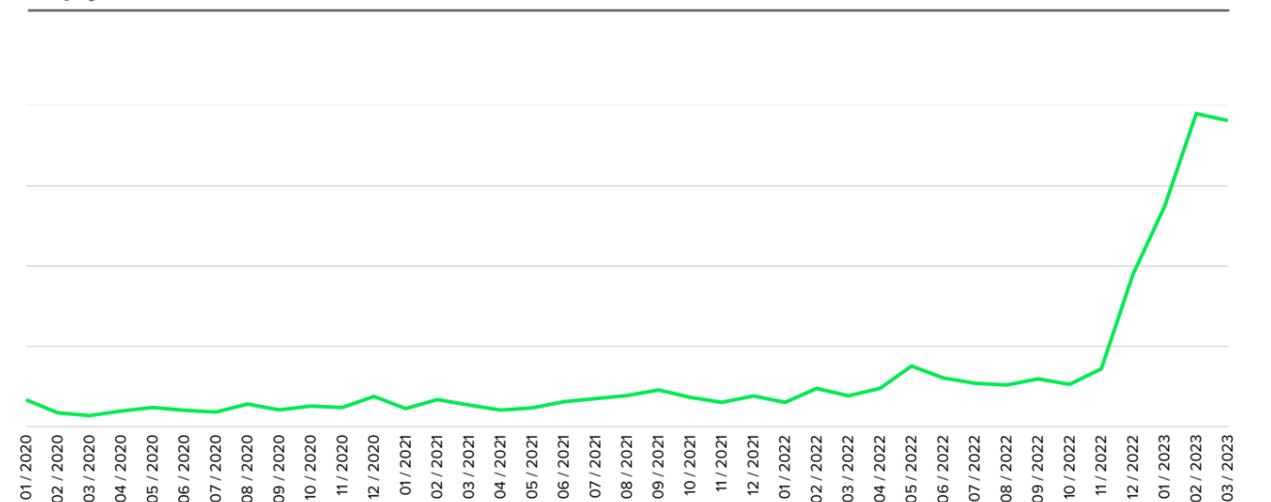
Source: Reply’s elaboration on publicly available data

Large language models: a snapshot of today’s main players

	OWNER	PARAMETERS	LICENCE	INPUT	OUTPUT	PUBLIC API
GPT-4	OpenAI	Undisclosed	Proprietary	Text, images	Text	Yes
LLaMa	Meta	65 billion	Proprietary	Text	Text	No
YaLM 100B	Yandex	100 billion	Open source	Text	Text	No
LaMDA	Google	137 billion	Proprietary	Text	Text	No
PALM	Google	540 billion	Proprietary	Text	Text	Announced
BERT	Google	340 million	Open source	Text	Text	No
Chinchilla	DeepMind	70 billion	Proprietary	Text	Text	No

Year 1 A.C. (After ChatGPT)

Reply Sonar: Volume Score for “Generative AI”





Generative AI's growth has played out in little more than a year, and one of the most interesting aspects has been how quickly it has moved beyond a pure consumer phenomenon and started to take root in the enterprise space. First came the intriguing results of generative image creation, and then the quick global success of ChatGPT at the end of 2022 determined a general and wider interest from the public in Generative AI. That trend is continuing and increasing in 2023.

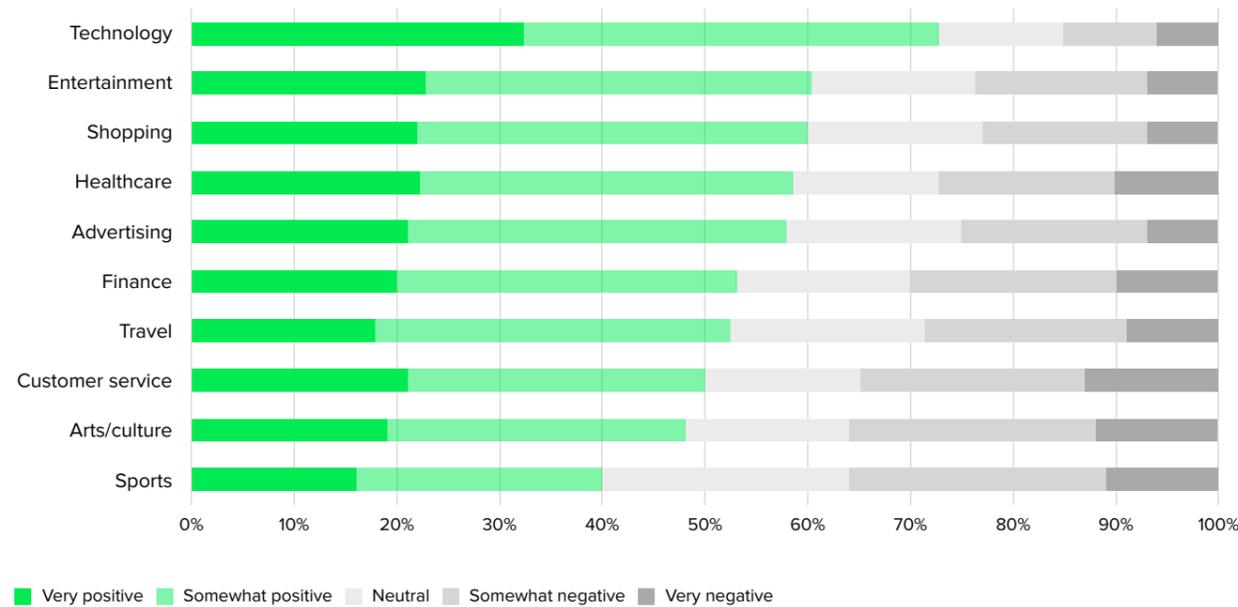
Some of the major consumer brands have revealed that they have adopted large language models and text-to-image models in supporting advertising campaigns, while professional architects, interior designers, and authors have also showcased their professional experience in using Generative AI. Its enterprise use, however, has the potential to explode in a myriad of potential use cases and industries.

As business leaders explore the potential efficiency brought by Generative AI tools, consumers are developing varied expectations for different industries. According to a survey conducted among US consumers, the expected impact is widely seen as positive for technology, entertainment, and healthcare. However, there are mixed feelings regarding customer service, possibly due to unsatisfactory experiences with previous generations of “dumb” chatbots and virtual agents.

Although it is impossible to capture a picture of a continuously growing river, this report aims to provide Executives with insights into how Generative AI models are currently exerting their power in real-world applications and what potential implications this may entail. Thanks to the expertise in Generative AI of several Reply Group companies from different countries and their experiences with customers from diverse industries, we have been able to share insights on the current use of this technology in various fields.

Perceived Impact of Generative AI on the Following Industries

Source: [Dentsu, 2023]



This study will centre on the most relevant Reply markets, and it will include an estimation of the evolution of their market size from 2022 to 2027: Germany, Italy, the USA, the UK, Brazil, France, Belgium, China, India, Poland, Romania, and the Netherlands. To gain a better understanding of current trends, we also used Reply Sonar, an AI-based tool that was developed together with the German Research Centre for Artificial Intelligence, DFKI. The tool analyses more than 50 million articles taken from relevant expert media, such as scientific journals, patents, papers, and B2B content platforms.

Read more about [Reply Sonar](#)



A Glimpse into the First Use Cases of Generative AI

“ The future of generative AI is an ever-expanding universe of use cases. Every single part of the enterprise can reap benefits from this technology – from the contact center to marketing, product development, content generation, human resources, employee support, and customer experience. We have only begun to scratch the surface of what’s possible with these models today – and the pace of model development is delivering richer capabilities all the time. Enterprises must begin exploring these capabilities today – and should construct a strategy around how generative AI will impact their company from both the top down and the bottom up. ”

[Forrester, 2022]

Three popular use cases

Generative AI uses algorithms to generate new data based on patterns it has learned from pre-existing data. The key advantage of this technology is that it can create brand-new, previously unseen data, which can be useful in different corporate domains and business cases. The technology is evolving by applying advanced machine learning techniques to the large language models, which are considered the cornerstone of Generative AI.

Large language models are built using a deep learning architecture called “Transformer”, which allows them to process and generate vast amounts of natural language text. As a result, they can generate coherent, human-like responses, in different formats. In the last two years, Reply widely utilised large language models, like GPT-3, in a wide range of industries. Activities like sentiment analysis (100% of accuracy score), structuring data (87% of accuracy score), and e-mail information capturing (86% of accuracy score) were examples of real-world usage of transformers and natural language processing features.

Learn more about [GPT-3's potential according to Reply](#)

The use of large language models and text-to-image models is rapidly increasing due to the invention of a new generation of user-friendly tools that are useful for creators working with text, images, and videos. Other fields, such as AI-powered software engineering and customer interaction, are also gaining in popularity among employees and executives due to the efficiency and speed of these new models.

Text, Translations, Images, and Videos for Creators

One of the most well-established use cases for commercial adoption in the realm of artificial intelligence is Generative AI-driven copywriting. This involves leveraging AI technology to generate numerous forms of written content, such as website



copy, social media posts, blog articles, and many other marketing materials. Models accessible through API, such as OpenAI's GPT family, serve as the foundation for numerous applications, which are designed to produce diverse text types in multiple languages.

By simply providing prompts comprised of keywords, specifying the target audience, and selecting a writing style, users can easily and quickly create content. Indeed, large language models can be utilised to create multilingual content simultaneously. Thus, effectively eliminating the need for manual translations and ultimately, streamlining the process of content creation.

This capability not only saves time and resources but also facilitates seamless communication and collaboration across borders, fostering global understanding and interconnectedness. These systems are able to adapt, learn and adhere to the nuances of different languages: the quality of translations of platforms like DeepL, for example, is growing rapidly, and has been recognised by both academic experts and professional translators, with a constantly declining "time-to-edit" [Translated, 2022].

The use of natural language processing and large language models' technology is transforming the content-editing industry by offering solutions that not only deliver speed and efficiency but also maintain a high degree of accuracy and contextual relevance. This is achieved through the continuous analysis of vast amounts of text data, which enables the AI to discern linguistic patterns, idiomatic expressions, and cultural references specific to each language.

As a result, content pieces retain their intended meaning and tone, as the language produced appears authentic cultivating an engaging experience for the target audience. As large language models become more advanced, they will be fine-tuned to cater to specific industries and technical jargon, thereby ensuring that generated contents and translations are even more precise and relevant to their intended context.

Another popular use of Generative AI is image sourcing for blog posts, presentations, websites and advertisements. Its use becomes compelling when a company needs a very specific or unusual image that is unlikely to be available in stock image libraries. Companies have long leveraged the latter, but they are now increasingly exploring the potential of solutions like Dall-E 2 by OpenAI, Stable Diffusion by Stability AI, and Midjourney, based on text-to-image models, to create unique images at a faster rate and a much lower cost. Incumbents are also entering the market, such as Adobe's release of Firefly.

For sourcing images, users need to define a style and keywords, and the AI will generate a corresponding image in just a few minutes. However, the importance of well-written, detailed prompts is crucial, even more so than in the case of text generation. This has paved the way for the empowerment of new professional figures, such as prompt engineers. Their skills are a mix between a programmer that selects the detailed parameters for the images and a creative that identifies the style, selects and "upscales" the proposed alternatives. The process can be iterative, so companies can generate different images corresponding to the prompts. This allows them to generate visually compelling and original content in high volumes, without breaking increasingly pressurised marketing budgets.

For example, Deephaven used Dall-E 2 to generate the thumbnails for its blogs, as blog posts with images typically drive a level of engagement that is twice as high as those without images. The company often found it challenging to find stock photos linked to specific and often technical topics, such as "Redpanda for streaming analytics" or "using Kafka with Parquet for storage". Due to budget limitations, the company's engineers could only spend a few minutes searching in stock libraries, so the images often represented a compromise rather than a good match for a post. By leveraging Dall-E 2, the company was able to generate



new thumbnails that better represented the content of more than 100 posts, in the space of a single weekend and for 45 USD [Deephaven, 2022].

Companies are used to doing A/B testing to choose the right visuals, but the number of visual variations (text, colours, and layouts) are limited in time and budget. Digital Asset Management platforms (DAM) can use Generative AI to automate and scale the creation of image variations for their users by testing different facial expressions, models, backgrounds, and props. Existing assets can also be repurposed to tell different stories to tailor the company's visuals to different target demographics or regions to better deliver their business goals.

Building Generative AI capabilities in DAM platforms allows users to customise their visuals much faster and the changes can be applied across all existing visuals in one go. Reply introduced a new integration with text-to-image tools in its DAM solution, Discovery Reply, letting users rapidly create and deliver generated images on different channels.

[Learn more about the Discovery Reply platform](#)

An example of the use of Generative AI in creative industries is fashion. Designers can use it to generate new designs according to fashion trends, resulting in increased efficiency, reduced costs, and greater accuracy in fashion design. Traditionally, creating a new fashion design would involve a lot of trial and error, as designers would need to sketch out numerous designs and then create prototypes to test them. With Generative AI, designers can input specific parameters and generate hundreds or even thousands of designs in a matter of minutes, greatly reducing time, costs, and potential waste of the design process.

Generative AI also allows for greater personalisation: by inputting specific criteria, such as colour, texture, and style, designers can create designs that are tailored to a specific customer or market segment. However, since Generative AI uses datasets

of images and other information to learn patterns and styles, there is a risk that the generated designs may be too similar to pre-existing designs, leading to accusations of plagiarism or copyright infringement.

The easiness of using Generative AI can also be a challenge for designers: it could be effortlessly used to create counterfeit products or designs. As Generative AI algorithms become more sophisticated, it may become easier for individuals or organisations to create fake products that are difficult to distinguish from genuine ones.

New Applications of AI for Software Engineers

Artificial Intelligence can help ICT professionals in various stages of the software development life cycle by supporting them in many activities, such as writing user stories, editing and reviewing code, detecting bugs, and testing software. This can lead to better workflows, greater productivity, and reduced time-to-market. The main advantage of AI-powered tools is their ability to improve efficiency: developers can subsequently focus on higher-level and more valuable activities, ultimately leading to increased productivity and effectiveness. AI is not just a tool, but a functioning team player that can aid developers to achieve better results.

For years, open repositories such as GitHub have collected millions of lines of code from professionals around the world. More recently, organizations such as HuggingFace have become the reference for AI models, datasets, and other useful materials for ICT professionals. These vast amounts of knowledge are mainly available as text and thus are a great source for contributing to the specialization in the development of models such as Codex or GPT-3.5 Turbo.



Large language models used in software engineering include text-to-code generation, i.e., generating code based on provided natural language description; code auto-completion, i.e., completing the whole function of code given the target function name, and code summarisation or explanation, i.e., generating the summary of a function in natural language descriptions.

Probably the most well-known tools are coding companions from hyperscalers that provide developers with suggestions for whole lines or entire functions right inside the code editor. For example, Microsoft, together with GitHub, launched its coding companion, Copilot, leveraging models co-developed with OpenAI to turn simple natural language instructions into over a dozen popular coding languages. Copilot, trained by ingesting massive quantities of computer code, can convert comments to code, auto-fill repetitive code, suggest tests and show alternatives.

Amazon launched its AI pair programming tool named CodeWhisperer. In addition to providing code suggestions in different programming languages, the tool understands how AWS services work and can generate potentially useful suggestions for those building on the AWS platform. Google has a tool for internal use and it claims that employees using its AI code completion tool saw a 6% reduction in coding iteration time [Tabachnyk, 2022].

These tools also enhance the performance of citizen developers, with Generative AI implemented in low-code and no-code tools. For example, no-code platforms such as Boltzbit put deep learning into the hands of everyone. According to the company, it drives a five-fold improvement in the time it takes to deploy projects. Generative AI can also help non-technical users by providing text to a SQL database interface. In this case, the AI-powered system translates natural language questions into SQL queries, giving non-technical users a new level of access to relational databases. This high-potential area of Generative AI application, however, is still embryonic.

Software delivery teams often have difficulties with upgrading applications and Generative AI can help by driving a higher level of automation. IBM and RedHat recently announced a collaboration in Project Wisdom, a framework that enables the creation of cloud automation scripts using natural language for DevOps. The tool can handle simple tasks such as installing dependencies, provisioning servers and scaling a specific application.

Software development should go hand in hand with software documentation, but it is not always the case. The latter is sometimes incomplete or outdated. Generative AI applications can help to solve this issue by enabling the automation of software documentation tasks: AI-powered tools read code and auto-generate supporting documentation.

In addition, Generative AI can be used to generate data for machine learning models. Machine learning is a critical aspect of software development, as it enables software to learn and improve over time. However, machine learning models require large amounts of data to train effectively. Large language models can be used to generate synthetic data that closely resembles real-world data, making it easier and faster to train machine learning models. This can help developers create more effective and accurate machine learning models, leading to more powerful and innovative software.

Improving Customer Interaction

Artificial Intelligence has been a hugely important battleground for marketing specialists, and there is a growing uptake of AI tools to automatically track, analyse and interpret consumer behaviour, sentiment and interaction throughout numerous channels. AI can be used also in customer segmentation, in marketing effectiveness modelling, and to get insights to build personalised customer experiences.

Learn more about [Reply's view on AI-enhanced customer experience](#)



What was probably missing in some AI-powered marketing activities in recent years was the ability to complete “the last mile” automatically. Now, having all the aforementioned information at hand, Generative AI can create and deliver content that is tailored to specific customer needs and resonates with a consumer’s purchasing habits and emotional drivers.

Many aspects of the customer interaction domains can be improved with Generative AI. This includes automating outbound e-mails (up to 30% by 2025 [Gartner, 2023]), responding more accurately to questions from prospective customers, summarising sales discussions, and suggesting next steps including providing real-time coaching and feedback to sales operatives. The uncovered insights enable organizations to tweak and enhance content to engage with specific consumer segments more effectively.

The last five years have seen digital assistants and chatbots enter mainstream use, but often with mixed results. Many brands have had push-back from customers that did not receive accurate or unengaging and lacklustre responses to their queries, and a growing number of brands are exploring how large language models, combined with natural language processing, can enhance their current performance level.

Rather than pushing the customer through a chain of static events, Generative AI is being used to create natural, empathic conversations with intelligent digital humans. These AI-powered avatars are representations of people using deep learning, sometimes created by existing employee professional headshots (e.g., through Synthesia) and voices, to interact with customers. Digital humans, moreover, can be used by both users and business representatives in immersive contexts like the metaverse.

Moreover, AI helps digital humans to respond to customers in an emotionally intelligent way and hold meaningful conversations with them to guide them through interactions such as

troubleshooting, answering questions, or booking reservations. According to Replikr, a New Zealand startup, the use of digital humans in its omnichannel booking and patient engagement solution, drove a 150% improvement in patient engagement and booking completion rates [Replikr, 2023].

The announcement by OpenAI of introducing new plugins for ChatGPT is potentially disruptive for the future of human-AI interactions, and therefore for the customer interactions field. These plugins link ChatGPT to third-party applications, enabling interaction with APIs developed by organisations. By leveraging these plugins, conversational systems can access real-time and corporate knowledge-based information, and execute actions on behalf of users.

One relatively mature aspect of the use of AI in customer interaction is speech synthesis. This has been around for a while in voice assistants such as Siri, Alexa, or Google Assistant and applied across a wide variety of industries but Generative AI can make it even better by tuning them to deliver more dynamic, sympathetic and insightful responses. For example, as ChatGPT can imitate a human writer, Vall-E, a neural codec language model recently introduced by Microsoft, is able to imitate human speech.

According to the company, Vall-E leverages in-context learning capabilities to synthesise “high-quality personalised speech with only a 3-second enrolled recording of an unseen speaker as an acoustic prompt” [Schwart, 2023]. The technology could preserve the speaker’s emotion and acoustic environment of the prompt in synthesis and significantly outperforms previous text-to-speech synthesis technologies in terms of speech naturalness and speaker similarity.

Besides its “autonomous” uses in interactions between consumers and digital humans, Generative AI can also be used to automate complex after-call-work after-customer interactions



with “traditional” assistants or sales representatives. For example, BirchAI leverages transformer-based NLP for healthcare, insurance, banking, and other market segments. According to the company, its technology can reduce Average Handle Time by up to 35%. The platform Viable, instead, helps to analyse customer feedback quickly and accurately and generates automatically qualitative reports with the most relevant insights, e.g., urgency score, product themes, and user profiles.

Examples of industry-specific uses of Generative AI

The three popular use cases are just samples of the first wave of potential implementations. Generative AI has a high potential in streamlining business and operations, in fields like back-office processes or corporate legal departments. Moreover, different industries such as healthcare, pharmaceuticals, cybersecurity, publishing, and media are showing increasing potential in the adoption of Generative AI.

Healthcare & Pharmaceuticals

The use of Artificial Intelligence in Healthcare and Pharmaceuticals is consolidated. Reply, for example, gradually launched a wide range of AI-powered platforms that assists healthcare professionals and patients in long-distance relationships, hospital work, or advanced analysis of radiomics. Generative AI is opening new potential uses of Artificial Intelligence in different fields.

Learn more about
[X-RAIS Reply](#)

Generative adversarial networks were already promising results in generating synthetic Magnetic Resonance Imaging (MRI) data that can capture the distribution of real MRI, as well as in improving the quality of existing brain MRI images, e.g., segmentation, noise removal, and super-resolution.

Generative AI can help in medical imaging by generating realistic images that can be used to train and improve diagnostic algorithms. It can create synthetic medical images that mimic real-life scenarios, which can be used to train algorithms to recognise subtle patterns that may not be apparent to human eyes. AI algorithms can supply various angles of an X-ray image to visualise possible tumour growth outcomes and can also detect malignant developments by comparing the image of healthy organs from the databank with the affected one.

Other uses of Generative AI in healthcare focus on privacy, for example on data de-identification. In privacy-preserving virtual cameras for video therapy platforms, AI automatically detects a personal identifier such as a face and generates a synthetic replacement that reflects the original attributes. For example, in therapeutic video consultations, a synthetic digital human is automatically generated in place of the real patient image to protect their identity while preserving their facial expressions, gaze and head pose.

Using synthetic data allows healthcare organisations to resolve some ethical and legal issues while providing a viable alternative to sensitive data, such as personally identifiable information or personal health information that is difficult or illegal for third parties to collect and use for training purposes. Synthetic data replicates information gathered from real-world events without compromising the original data’s confidentiality and can be used without linking it to specific individuals. Synthetic patient data can be used to train machine learning algorithms for disease diagnosis and personalised medicine. This can save time and reduce costs associated with collecting real patient data and maintaining privacy.

Close to use in medical research, there is a huge potential for use in the pharmaceutical industry, and generally speaking in



life science. Developing new drugs is a time-consuming and expensive process that involves extensive testing and research. Deep learning algorithms can speed up the process by simulating the interactions between drug molecules and target proteins, which can help to identify new compounds that may be effective in the treatment of specific diseases. Additionally, AI can help in optimising drug formulations, such as dosage, delivery, and efficacy, by generating synthetic models that can be used to test and refine the drug development process.

Moreover, digital twins of patients created by Generative AI could overcome the recruiting of pharmaceutical trial participants, one major stumbling block in shepherding a drug through clinical trials. They can be used to simulate placebo outcomes for patients in clinical trials, meaning that companies will need to recruit significantly fewer human participants.

Cybersecurity

The use of Artificial Intelligence in Cybersecurity has been one of the main trends in the last years. As discussed in Reply Research “Cybersecurity Automation”, uses go from application security automation to endpoint security and incident management, from Internet of Things security to data security and protection. Generative AI is adding new use cases and layers of potential automation.

Anomaly detection is a critical component of cybersecurity, as it involves identifying unusual patterns or behaviours in a system that could indicate a cyber-attack. Usually, unsupervised machine learning models can be used to model normal system behaviour and identify any deviations from this model that may indicate an attack. By analysing vast amounts of data and detecting anomalies, AI can help identify potential threats and take necessary actions to prevent them.

Predictive models can be trained using historical data to identify patterns and trends that may indicate an impending cyber-attack. Generative AI can be used to simulate cyber-attacks and generate new data, which can then be used to train predictive models. By combining Generative AI with other machine learning techniques, such as supervised and unsupervised learning, predictive models can be made even more effective.

Generative AI could be trained to recognise common vulnerabilities in a system and then generate new attack scenarios that exploit these vulnerabilities. This allows cybersecurity professionals to remain ahead of potential threats by identifying and patching vulnerabilities before they can be exposed and exploited by attackers.

Another way Generative AI can enhance network security is through the creation of highly realistic “honeypots”. Honeypots are decoy systems that mimic real systems, and Generative AI makes them more effective at attracting attackers. These decoy systems are designed to lure attackers into a controlled environment where their behaviour can be observed and analysed.

The increasing speed and quantity of attacks have made it challenging for researchers and technicians to create new technologies to tip the balance in favour of defenders. Different vendors are working on the application of AI and Generative AI in the aforementioned fields. Microsoft, for example, announced “Security Copilot”, which uses GPT-4 to provide support and information on global cybersecurity threats. The platform allows security researchers to speed up responding to attacks, summarising events and processes, anticipating threat actors’ moves, and exposing researchers to new competencies.

In addition to the technical applications of Generative AI in preventing and fighting cybercrimes, large language models can also be used in the editing and validation of security policies

Learn more about
Reply Research
“Cybersecurity
Automation”



and procedures. By analysing vast amounts of already existing documents, laws and policies, they can suggest how to write/revise policies and procedures to be compliant and secure.

There are also challenges associated with the use of Generative AI in cybersecurity. One of the biggest challenges is the lack of quality training data. Generative AI models require large amounts of high-quality data in order to be trained effectively. In the case of cybersecurity, this means that data must be collected from a wide range of sources and must be accurate, as well as representative of real-world attacks.

Publishing & Media

Generative AI has the potential to revolutionise the media and publishing industries in a myriad of ways. From streamlining the editing processes to creating personalised digital content and entirely new genres of literature, Generative AI offers a wealth of opportunities for publishers to engage users and build a loyal following. Moreover, platforms such as Make-A-Video, Synthesia, and D-ID clearly demonstrate potential opportunities for organizations of all sizes to create videos.

In fact, the usage of Generative AI in publishing and media is often an extension of the aforementioned Generative AI for creators. However, while the use of Generative AI for creative people is often linked to the need to explore new creative ways and obtain more alternatives of text/images, for these industries, it is more than anything else a key to efficiency. An interesting example of the use of AI for supporting a publisher's content farm is the project led by Reply for Portobello, the Italian leader in media bartering.

Learn more about the [Reply project for Portobello](#)

The use of Generative AI in the media industry can streamline the production process, reducing the time and cost of production. Film and television studios can use large language models to

generate scripts and storylines, while video editors can use AI-powered tools to automatically cut and splice together footage, or to generate special effects and animations. Audio engineers can use AI to clean up audio recordings, remove background noise, and enhance sound quality.

AI-generated digital humans, characters and environments can be used to create more immersive and engaging entertainment experiences. AI-generated CGI can be used to create more realistic and lifelike characters and environments in films and video games. According to Gartner, 90% of a major blockbuster movie will be AI-generated by 2030 [Gartner, 2023]. Additionally, AI-generated animations can be used to create more dynamic and engaging promotional visual content for social media and other online platforms.

One of the most promising applications of Generative AI in the publishing and media industries is the creation of personalised content for individual users. By analysing data from a reader's past media consumption habits and preferences, for example, books and news content, Generative AI can create customised content that is tailored to that user's specific interests and preferences. This could include everything from personalised news articles to custom-designed book covers and even personalised movie recommendations.

Finally, Generative AI can be used to improve the accessibility of content for individuals with disabilities. The adoption of automatic speech recognition like Whisper has already improved the quality of "basic" usages like transcription and subtitling of videos. Currently, large language models enable the creation of synthetic/expanded versions of existing texts, videos, and audio that are readily accessible to individuals with visual, hearing, or cognitive impairments. This could help to make content more inclusive for a wider range of consumers, including, but not limited to, children with learning disabilities.



Challenges to Address as the Market Matures

“ Many are rightly worried about biases in the design and impact of AI systems. We are committed to robustly addressing this issue and being transparent about both our intentions and our progress. Towards that end, we are sharing a portion of our guidelines that pertain to political and controversial topics. Our guidelines are explicit that reviewers should not favor any political group. Biases that nevertheless may emerge from the process described above are bugs, not features. ”

From OpenAI's "How should AI systems behave, and who should decide?" [OpenAI, 2023]

Before anything else: Ethical and Responsible AI

While Generative AI promises multitudes of positive opportunities, some challenges and concerns lie ahead. Understanding the limitations and consequences of this new technology is essential for conceptualising a beneficial and responsible future with it. Some of the worrying aspects of Generative AI have already arisen among professionals in the last few years, but the actual global overuse now makes the need for ethical and responsible AI most evident.

This increased risk comes from the fact that Generative AI is a really powerful technology and has the capacity to create content that is offensive, discriminatory, or harmful. For example, Generative AI could generate images of individuals based on racial or gender stereotypes, perpetuating harmful human biases and prejudices. The bias and discrimination concerns raised by Generative AI stem from the fact that AI is only as unbiased as the data it is trained on. If the data used to train the AI is biased, the content it generates will also be biased.

For example, the popular open-source LAION-5B data set is widely used for generative image platforms but is skewed towards sexist and racist images due to its collection from the Internet. This could lead to AI models that can sexualise women irrespective of their consent or recommend images of exclusively white men when prompted to create “professional pictures”. The issue is widespread in the sector, as other proprietary AIs are built in a similar manner.

If a Generative AI model is trained on a dataset that has a biased representation of a particular group, the model may generate outputs that discriminate against that group. This is a particular concern when it comes to sensitive areas such as hiring, lending, and healthcare. If Generative AI models are used to make decisions that impact people's lives, then it is crucial that they are trained on diverse and representative data to prevent discrimination.



Moreover, the use of Generative AI in certain industries, such as healthcare or education, could raise questions about privacy and security. Many Generative AI models require access to large amounts of personal data to generate their outputs. This can create privacy concerns, as people may not be aware of how their data is being used or may not have given their consent for it to be used in this way. Additionally, there is a potential risk that Generative AI could be used to re-identify individuals from anonymised datasets, which could compromise their privacy.

It is crucial to regulate the use of Generative AI and develop ethical guidelines to ensure that the technology is used for positive progression. To mitigate risks, transparency, accountability, and fairness should be the guiding principles. Generative AI developers must be transparent about the data they use to train their models and accountable for the outputs generated by such models. It is also important to use Generative AI fairly and ethically, with a focus on promoting the public good and avoiding harm. To promote the responsible use of Generative AI, it is also essential to invest in research that examines the ethical implications of this technology.

Massive data needs & Synthetic Data

One way to avoid biases in datasets is to extend them significantly: more diverse datasets lead to stronger models. In this sense, the use of synthetic data is an asset for both model creators and companies that use Generative AI for internal or external applications. The use of synthetic data for training Generative AI models has several benefits over using real data, including reducing the cost of data collection and labelling, providing control over the distribution of data, and improving the privacy and security of sensitive datasets.

Synthetic data can help to improve the privacy and security of sensitive datasets. In some cases, real-world data may contain sensitive or confidential information, such as personal data, trade secrets, or classified information. Synthetic data can be generated to mimic the real-world dataset while protecting sensitive information, allowing for the creation of a synthetic dataset that can be safely shared and used without compromising the original data's privacy and security.

One of the most significant benefits of synthetic data is the ability to create larger and more diverse datasets than would be possible with real data. Synthetic data allows for a much more significant degree of control over the dataset's distribution, making it possible to create samples that are outside the scope of what is available in real-world datasets. This can help to improve the model's ability to generate diverse and realistic samples.

Synthetic data can be produced by applying a variety of techniques and they can be used to develop test data and to create training data for machine learning algorithms. Interestingly, one of the most effective ways to create synthetic data is Generative AI, with a potential virtuous/vicious circle based on the algorithms and the expected outcomes/weight of synthetic data vs. real data. In fact, the quality of the synthetic data heavily depends on the algorithm used to generate it. If the algorithm is poorly designed or trained, the synthetic data may not be representative of the real-world data, leading to poor model performance.

Another benefit of synthetic data is the ability to create labelled data, which is essential for supervised machine learning models. In real-world datasets, labelling data can be time-consuming and expensive, often requiring human intervention. Synthetic data, on the other hand, can be easily labelled by the algorithm that generated it, reducing the time and cost of labelling significantly.

Despite the many benefits of using synthetic data for Generative AI, there are also some potential drawbacks to consider. One of the



primary concerns is that synthetic data may not fully capture the complexity and diversity of real-world data, leading to models that are overfitting or not generalising well.

In the medium-long term, when the Internet will be literally flooded by texts, images, and videos created by Generative AI, datasets could become poor, and barely useful to represent original human creativity and distinctiveness. The definition of “truth” itself could become difficult to handle in a world based on synthetic data generated, willingly or not, with content based on false, partial, or biased information and then stem for years in new content, used as the base to train other algorithms, and so on.

First potential legal issues about Generative AI

Besides the ethical problems coming from biased/wrong data in knowledge bases used to train the models, different legal issues are coming up in different industries, also driven by the huge use by consumers. Among others, some of the main legal implications could include:

- ▶ Property of input data used to build models
- ▶ Implications on people’s private data and corporate’s reserved information used to train or prompt the models
- ▶ Property of models
- ▶ Property of generated outputs
- ▶ Property of input prompts
- ▶ Responsibility for wrong information and deriving actions/effects
- ▶ Responsibility for offensive/illegal images.

A clear sign that Artificial Intelligence, and Generative AI particularly, has truly entered the mainstream is the growing scrutiny it is receiving from regulators. The Chinese Government, for example, became one of the first state organisations to introduce guidance on how it is used, amid much wider global discussions around the governance frameworks that need to be in place to ensure that it is deployed ethically. Recently, different Privacy Authorities started to request more transparency from market leaders.

Generative AI models can be trained to create content that resembles existing content, such as music or art. While this has the potential to be a great tool for artists and creators, there is also a risk that it could lead to intellectual property infringement. For instance, a Generative AI model could be trained to create music that sounds similar to an existing artist’s work, leading to copyright issues and potential legal battles.

In fact, while Generative AI has the ability to create new content, it is still limited by the data it is trained on. This means that the content generated by machines is often a variation of what has been seen before. This could lead to a reduction in the diversity of creative output, as machines generate content that is similar to what has been seen before, rather than creating entirely new and original content.

A technique to deal with legal issues is watermarking the generated content, as OpenAI has done with Dall-E 2. This technique helps reduce counterfeiting by allowing users to easily detect whether a particular piece of content was generated by the AI or not. AI-powered Web platforms are also able to spot generated texts, thanks to patterns identified in a textual content. This could also have mid-term implications on the positioning of content on main search engines.



Traditionally, copyright law has been used to protect the rights of creators of original content, such as writers, musicians, and artists. However, when it comes to content generated by AI, the question of ownership becomes convoluted. If Generative AI systems are creating content, who owns the copyright? Should those machines be granted legal personhood, or should the ownership of the content created by machines be attributed to their human creators?

In some cases, the owner of the Generative AI software may be considered the owner of the content that it generates. In other cases, the user who inputs the data or parameters that the AI uses to generate content may be considered the owner, e.g., prompts used for creating images by prompt engineers. Further still, in other cases, the content may be deemed public property.

Similarly, liability for the content generated by AI is also a complex legal issue. If the content generated by AI infringes on someone else's intellectual property rights, such as by using copyrighted material without permission, who is liable? Is it the owner of the Generative AI software, the user who inputs the data or parameters, or the AI itself? If the content generated by AI is defamatory or otherwise harmful, who is liable for any damages that result?

There is a growing concern in the publishing and marketing industries over who owns the copyright of the many creative works that are being published after using Generative AI tools. A recent ruling in the U.S. Copyright Office (USCO) set a precedent, by stating that it "will not knowingly grant registration to a work that was claimed to have been created solely by machine with artificial intelligence" [Lancaster, 2023], in fact imposing the guideline that images produced solely by Generative AI are not copyrightable, but the text and arrangement of the images and text can be copyrighted.

The decision states that since AI lacks creativity and the user doesn't exercise full creative control over the output, there is no human author and, therefore, no copyright protection. The USCO equates AI-generated works to those of an artist commissioned by a buyer, where the machine determines how the instructions are executed, not the human user. The ruling could also imply that AI-generated works may be used freely without the owner's permission, as they do not have copyright protection.

As Generative AI systems become more widespread, questions arise about how to financially compensate authors and creators whose work is being used in the training of the models, and whether they should have the option to opt-out their work from the training base. One solution to this problem is a platform called "HaveBeen Trained," which helps individuals and creatives check if their image creations have been used to train a Generative AI system. The platform searches mostly inside the Laion-5B and Laion-400M popular image datasets and partners with Laion to help creatives remove their work from the database if requested.

Beware of malicious uses of Generative AI

The use of AI to create highly convincing (fake) images or videos, known as deep fakes, poses a significant threat to the spread of misinformation. Generative AI makes it possible to create convincing images and videos of people saying or doing things they never did. This technology could be used for political propaganda or to manipulate public opinion. For instance, a deep fake video of a political candidate making controversial statements could be shared online, potentially influencing the outcome of an election.



Moreover, the technology can be used to generate realistic images of individuals without their consent, which can be used for nefarious purposes such as identity theft, blackmail, or stalking. Generative AI systems could also be used to generate realistic passwords, which could potentially grant access to sensitive information. The models could be used to create fake fingerprints or facial recognition data, which could then be used to bypass security systems.

Another potential misuse of Generative AI is the creation of fake identities. With Generative AI, it is possible to create realistic images and profiles of people that do not actually exist. This could be used for various purposes, such as creating fake social media accounts to spread propaganda or conducting phishing scams. There is also a risk that Generative AI could be used to create fake documents, such as passports or identity cards, which could be used for fraudulent purposes.

In the field of cybercrime investigation, Generative AI's ability to create realistic images and videos could be used to create fake evidence that could be used to frame and implicate innocent people. For example, a Generative AI algorithm could be used to create a convincing image of a suspect committing a crime, even though they were not involved.

“ ChatGPT creating malware is legit scary. Not really because malware is anything new, but rather because ChatGPT can do it endlessly. AIs don't sleep. ”

Tim Marcin, Mashable [Marcin, 2023]

The high potential of large language models could bring the development of “evil projects” of unsettling proportions. Generative AI could be used and exploited by attackers to create more sophisticated attacks. For example, by using Generative AI to create fake network traffic that is indistinguishable from legitimate traffic, attackers could bypass traditional security measures, making it more difficult for security analysts to detect and prevent attacks, or create custom malware specifically designed to evade detection by traditional antivirus software.

The issue of who should be held responsible for harm caused by AI systems is frequently raised in discussions about the use of AI. In response to this concern, the European Commission is working on regulations for AI systems, which include addressing the issue of liability. However, regulating AI liability is a complex task, and the Commission's recent legislative efforts have highlighted the challenges involved.

Lawmakers must ensure that AI systems are safe to use, and the Commission's proposed directives aim to protect victims of AI harm by establishing liability rules. The effectiveness of these rules in addressing liability concerns and facilitating compensation for those harmed by AI systems must be carefully evaluated.

Generative AI must become more environment-friendly

The development of high-performance, AI-powered tools, platforms, and services is likely to cause a significant increase in the amount of energy that tech companies require and the amount of carbon they emit. The incorporation of AI into main search engine leaders, for example, requires potentially enormous amounts of computing effort, and therefore a significant increase in the environmental footprint.



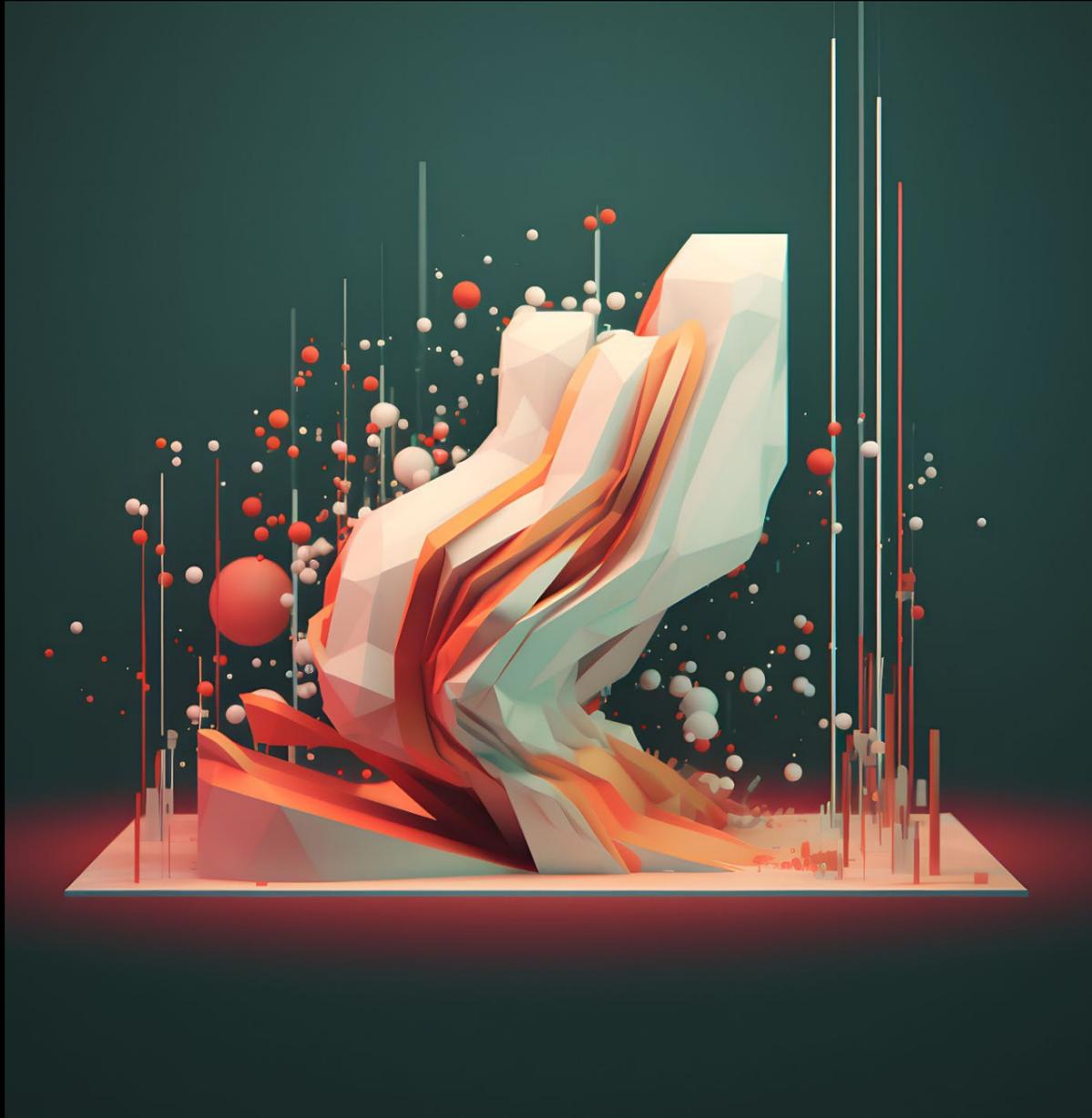
Moreover, to enable Generative AI systems to become better at generating content, the amount of data required to train them also increases. This could lead to a significant increase in energy consumption and carbon emissions since large data centres are needed to store and process this data. In fact, the process of training AI models requires significant computing power and energy consumption, which has a direct impact on the environment.

Even if main players are using cloud computing as the infrastructure solution to run their systems, the data centres that host these models require a vast amount of energy to operate and only some providers are adopting totally “clean” energy to power them. In addition, the training of Generative AI models requires a significant amount of water to cool the machines.

The use of Generative AI also leads to an increase in electronic waste. The machines used to train and run AI models and their CPU/GPUs are replaced frequently, leading to a build-up of electronic waste in landfills. Additionally, as Generative AI continues to evolve and become more complex, the demand for more advanced computing hardware will increase, leading to even higher levels of electronic waste.

Generative AI can also contribute to the proliferation of digital waste. As technology becomes more advanced, the output of Generative AI models will become more sophisticated and realistic. This can lead to an increase in the production of digital media, such as images and videos that are never used and eventually discarded. This digital waste can even have a significant environmental impact since it requires energy and resources to be stored.

As Generative AI technology continues to advance, hopefully, new hardware solutions will emerge that can help to reduce energy consumption and minimise the environmental impact. Right now, companies must account for the potential impact of enterprise-wide use of Generative AI, while they update their sustainability reports. Using Generative AI systems that run on totally environment-friendly cloud computing providers can be the first solution. Ultimately, Artificial Intelligence has great potential in improving sustainable practices, for example in optimising the energy usage of companies.



Sizing the Generative AI Market

“ Generative AI is a topic that has generated a huge amount of hype within a very short timescale. It remains at a very early stage of maturity and advances in technology, as well as regulatory frameworks, will continue to shape the use of the technology in the coming years. But there are already some compelling use cases that are emerging in the commercial sector, and business leaders should look to test its potential in enhancing key parts of their operations in the months ahead. ”

Nick Mayes, Principal Analyst at PAC

A fast-growing niche, as part of an exploding market

Thanks to a collaboration with PAC, we are able to define forecast data for 2022-2027. Estimations are split between Services and Software & Cloud Platforms, and presented in two clusters:

- ▶ Big-6, including the USA, China, the UK, Germany, France, and India
- ▶ Rising-6, which includes the Netherlands, Italy, Brazil, Belgium, Poland, and Romania.

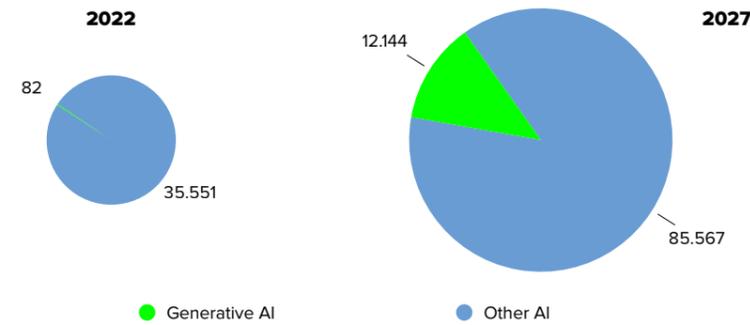
Generative AI is expected to grow in all the mentioned countries, with different rates and a wide range of incidence expected in 2027 vs. total investments in Artificial Intelligence. The latter will literally “explode” in the next 5 years in all mentioned countries, while Generative AI is expected to evolve as a fast-growing niche that will arrive at 12% of the total investments in 2027.

We also asked PAC analysts to share some C-level recommendations about how to address projects in Generative AI, as part of broader, steadily increasing, investments in Artificial Intelligence.



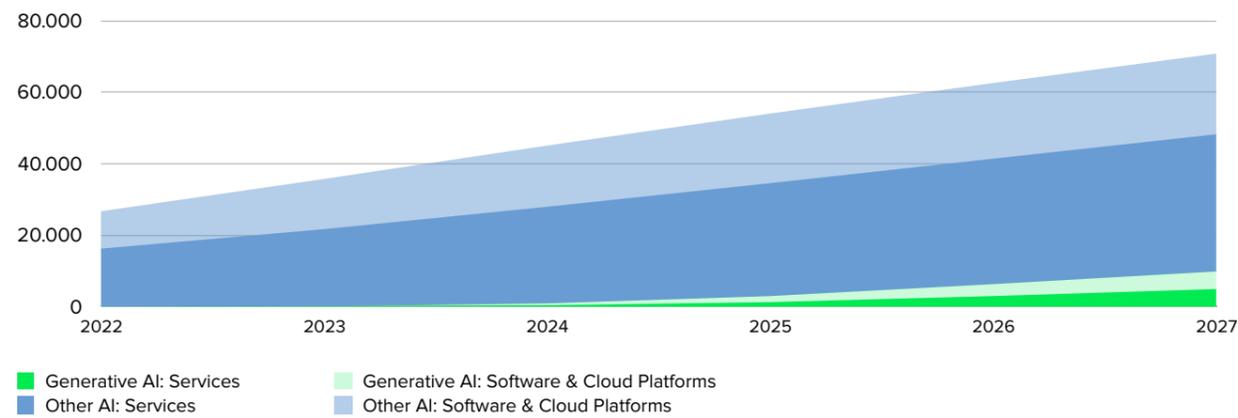
Focus on “Big-6” countries: USA, China, UK, Germany, France, and India

Big-6: comparison 2022-2027 of total investments in AI and Generative AI (million Euros)



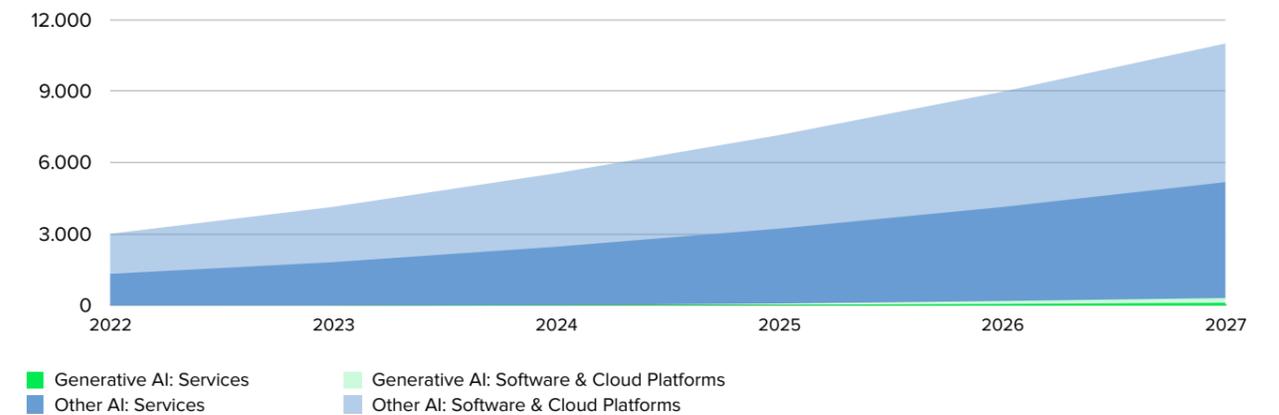
A high-level comparison of the Big-6 market evolution lets us see the increasing relevance that Generative AI will assume in the broader market of investments in Artificial Intelligence. While the former was less than 1% of a total market of almost 36 billion Euros in 2022, its weight will be more than 12% of a staggering market of almost 100 billion Euros in 2027.

USA: evolution 2022-2027 of total investments in AI and Generative AI (million Euros)



The United States of America is the biggest market analysed in the panel. The total market of investments in Artificial Intelligence will cross the 70 billion Euros mark by 2027, compared to 27 billion in 2022. In the next five years, the Generative AI market will reach 10 billion, equally split between Services and Software & Cloud Platforms.

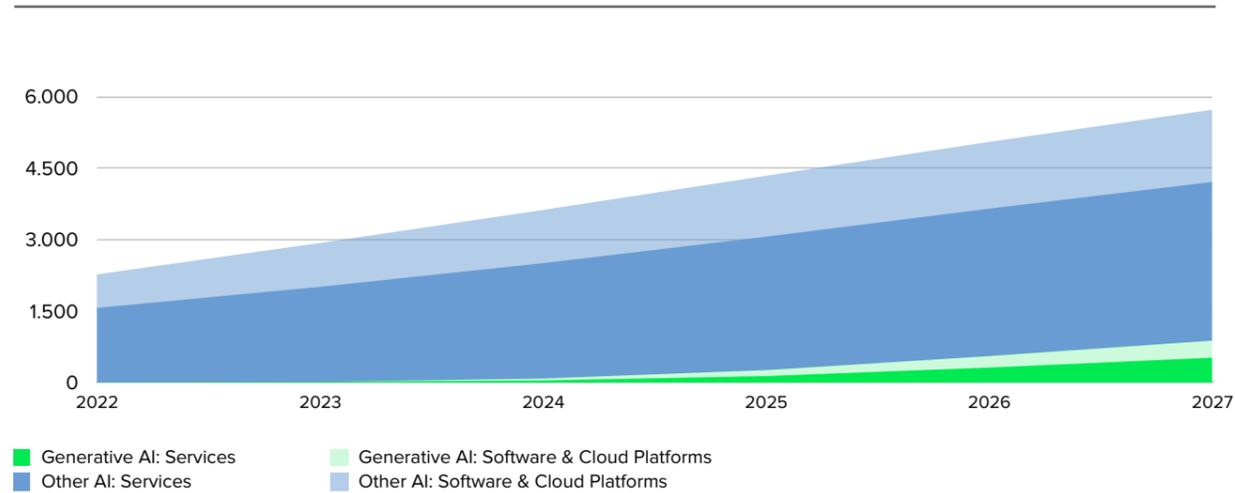
China: evolution 2022-2027 of total investments in AI and Generative AI (million Euros)



The total Chinese market of Artificial Intelligence will grow steadily, from 3 billion Euros in 2022 to 11 billion in 2027. Also Generative AI market will grow, up to 338 million. However, China is the country in the Big-6 cluster with the lowest incidence of investments in Generative AI vs. total AI, since they are forecast to reach just 3% in 2027.

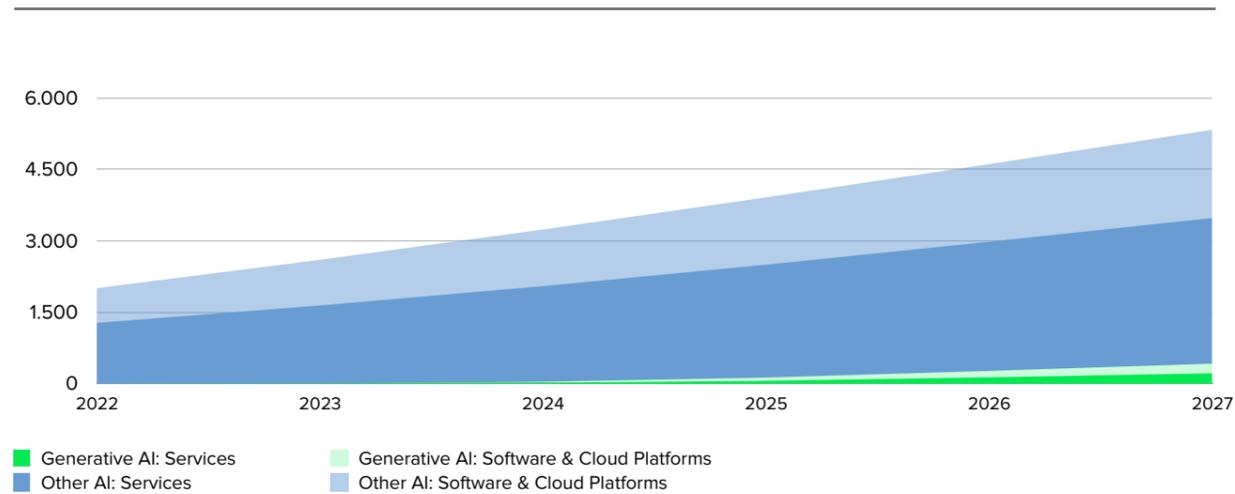


UK: evolution 2022-2027 of total investments in AI and Generative AI (million Euros)



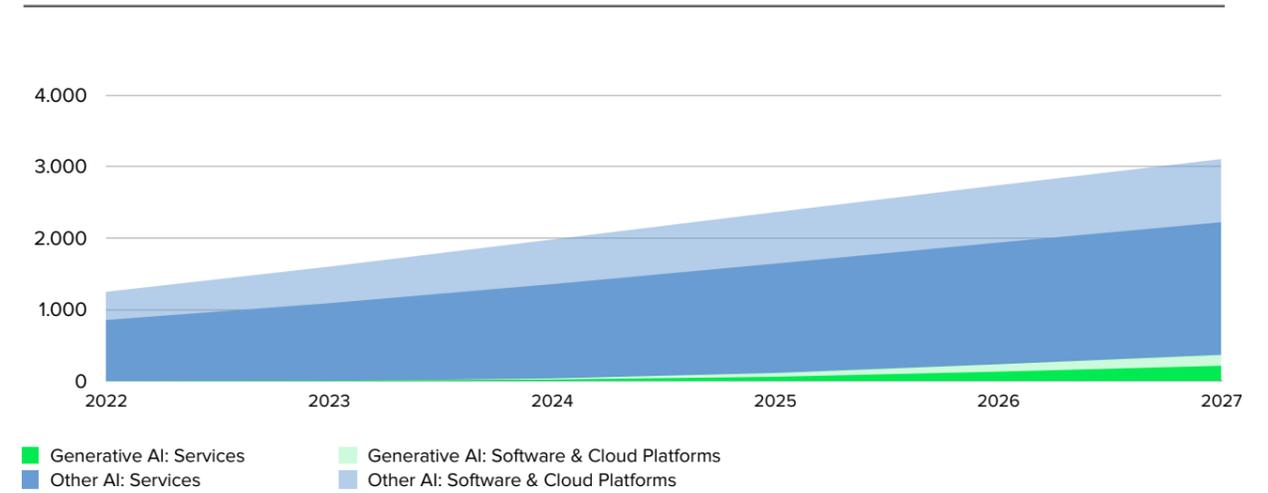
Opposite to China's low incidence, the United Kingdom is expected to get the highest incidence of Generative AI in the panel: in 2027 this 900 million Euros market will weigh for almost 16% of the total local 5.7 billion Euros total AI market. The Generative AI Services segment will be the higher incidence, with 525 million expected in 2027.

Germany: evolution 2022-2027 of total investments in AI and Generative AI (million Euros)



The size of the total AI market in Germany in 2022 was similar to the UK; however, the rate of growth will be higher, reaching 5.3 billion Euros in 2027. However, the incidence of the Generative AI market is expected to be just 8% for a total of 434 million Euros, equally split between Services and Software & Cloud Platforms.

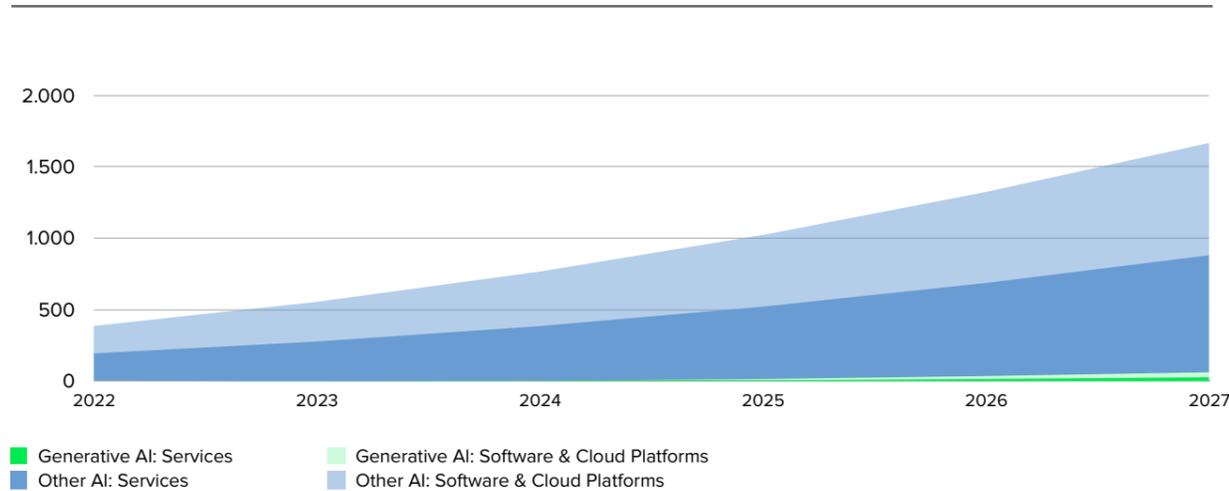
France: evolution 2022-2027 of total investments in AI and Generative AI (million Euros)



While the growth rate of the total French market of Artificial Intelligence will be similar to the German one, the development of Generative AI will be faster. This market will reach 375 million Euros out of a total of 3.1 billion, with an expected incidence of 12% and a higher weight of Services compared to Software & Cloud Platforms.



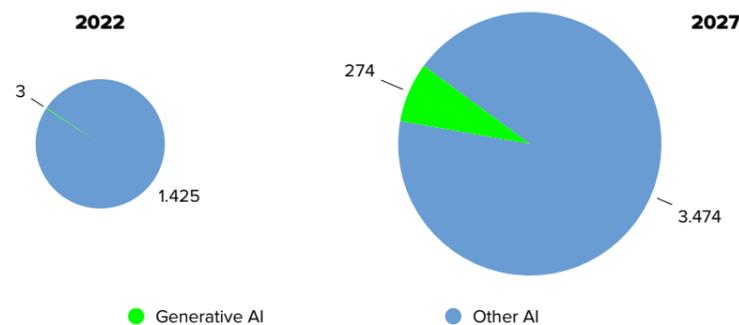
India: evolution 2022-2027 of total investments in AI and Generative AI (million Euros)



India was added to the “Big-6” cluster because of its predicted 4x growth of the Artificial Intelligence market, from 387 million Euros in 2022 to 1.67 billion in 2027. However, as we have seen for China, also in India the expected incidence of Generative AI in the next 5 years is limited, estimated at around 4%. In this country, the incidence of Software & Cloud Platforms for Generative AI will be higher than the Services segment.

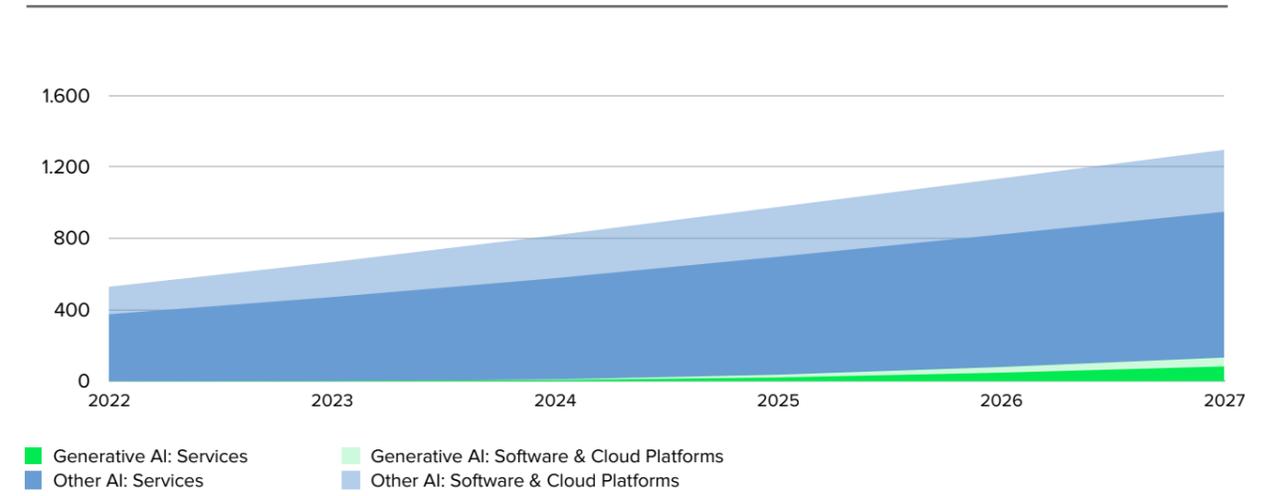
Focus on “Rising-6” countries: Netherlands, Italy, Brazil, Belgium, Poland, and Romania

Rising-6: comparison 2022-2027 of total investments in Generative AI (million Euros)



The high-level trends seen for the Big-6 cluster can be seen in the Rising-6 cluster too. In this case, both the total AI market and the Generative AI segment will increase significantly, but the incidence of the latter will be around 7% of a total of 3.7 billion Euros of investments in Artificial Intelligence in 2027.

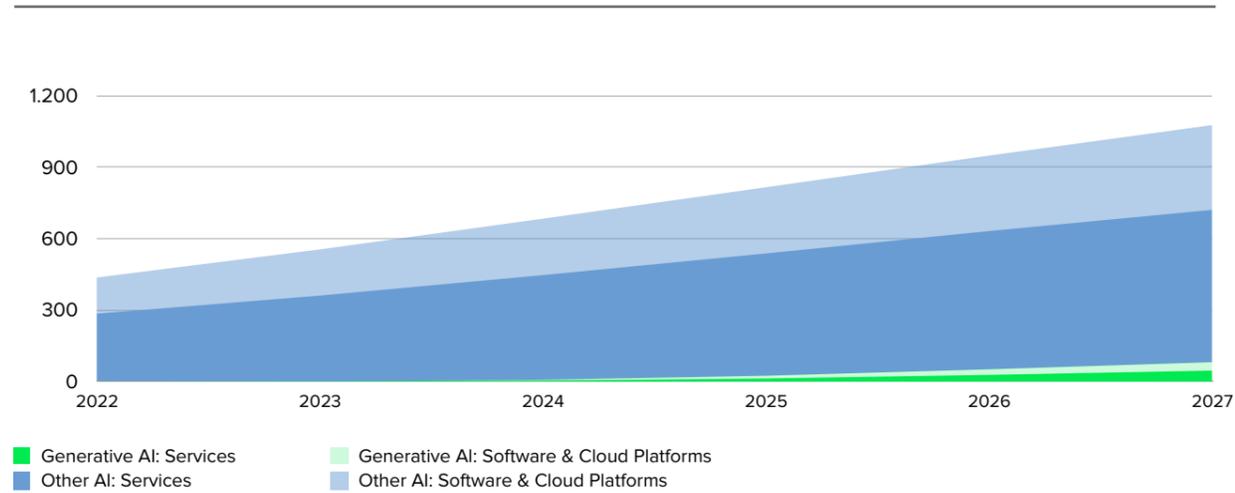
Netherlands: evolution 2022-2027 of total investments in AI and Generative AI (million Euros)



The Netherlands is the leading market in the “Rising-6” cluster, which includes countries where the total market is below 1.5 billion Euros by 2027. In this case, the Netherlands is expected to reach a total size of 1.3 billion Euros for investments in Artificial Intelligence. Generative AI will weigh 135 million, therefore almost 10% of the total. The Services segment will be far broader than Software & Cloud Platforms.

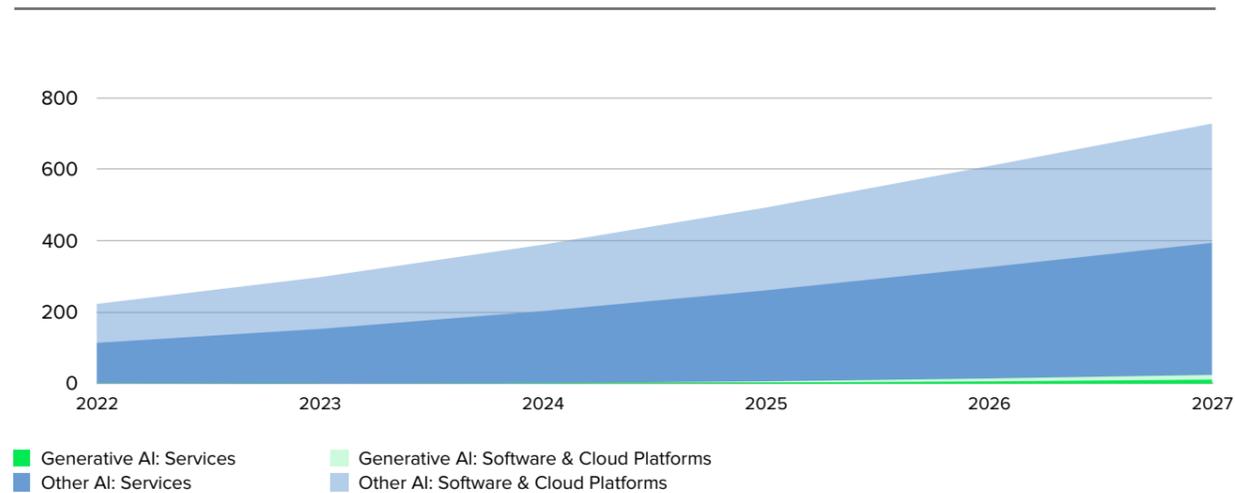


Italy: evolution 2022-2027 of total investments in AI and Generative AI (million Euros)



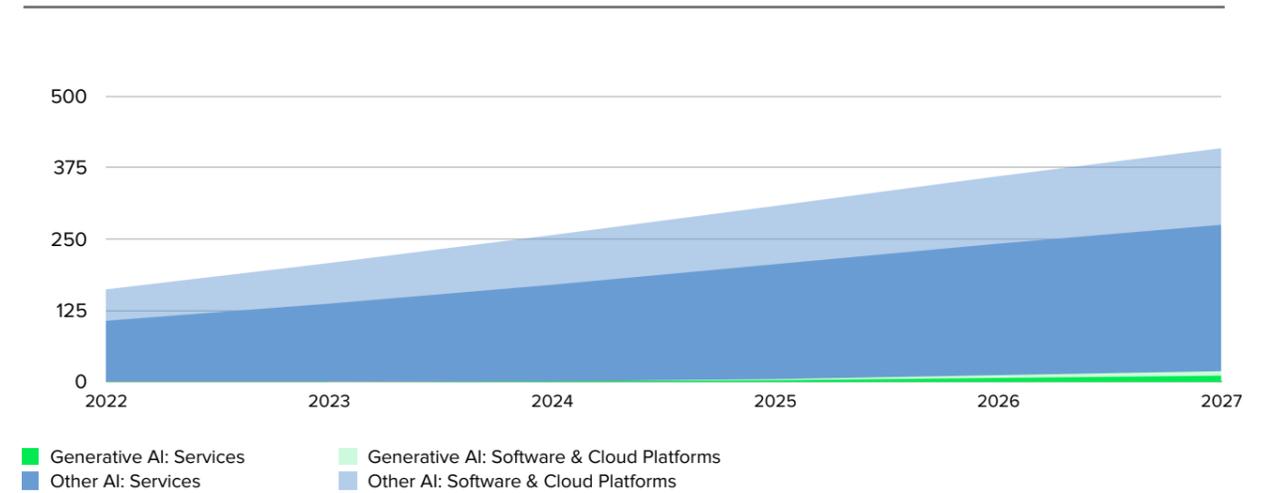
Italian market growth rate of total investments in Artificial Intelligence will be similar to the Deutsch one, but with slower growth (and therefore a minor incidence) of Generative AI in 2027: 84 out of 1.076 million Euros. The Generative AI Services segment will be slightly higher than Software & Cloud Platforms one.

Brazil: evolution 2022-2027 of total investments in AI and Generative AI (million Euros)



Brazilian total market of Artificial Intelligence will more than triple between 2022 and 2027: we expect it will be 729 million Euros. Nevertheless, as mentioned for China and India, the incidence of Generative AI will be pretty limited, less than 4%. The Software & Cloud Platforms segment will weigh more than the Services one (15 vs. 11 million Euros).

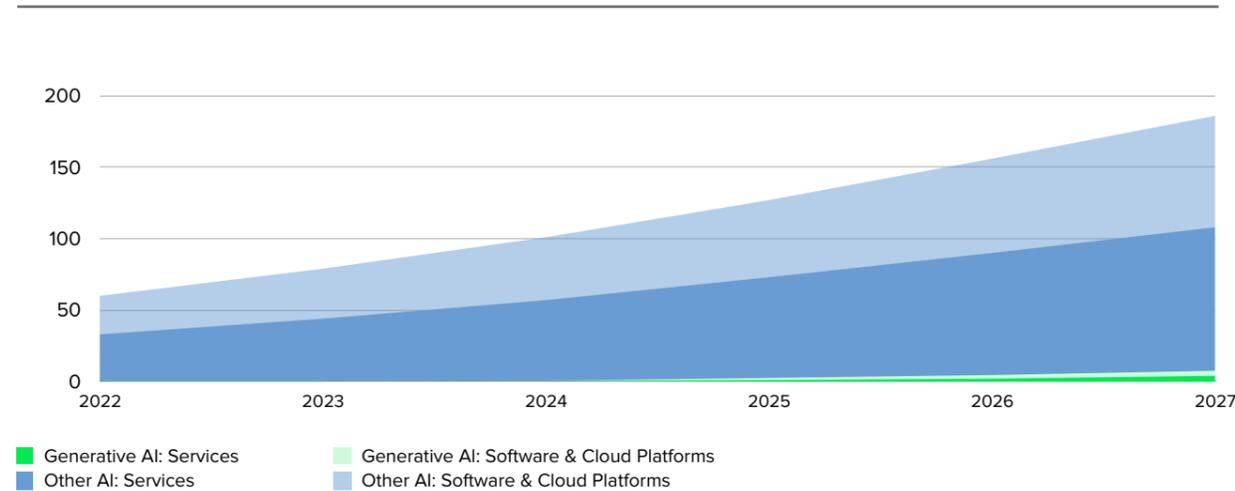
Belgium: evolution 2022-2027 of total investments in AI and Generative AI (million Euros)



Belgian total market of Artificial Intelligence is forecast to grow from 162 million Euros in 2022 up to 407 million in 2027. The incidence of Generative AI will be less than 5%, up to 19 million Euros, with a higher weight of the Generative AI Services segment than Software & Cloud Platforms.

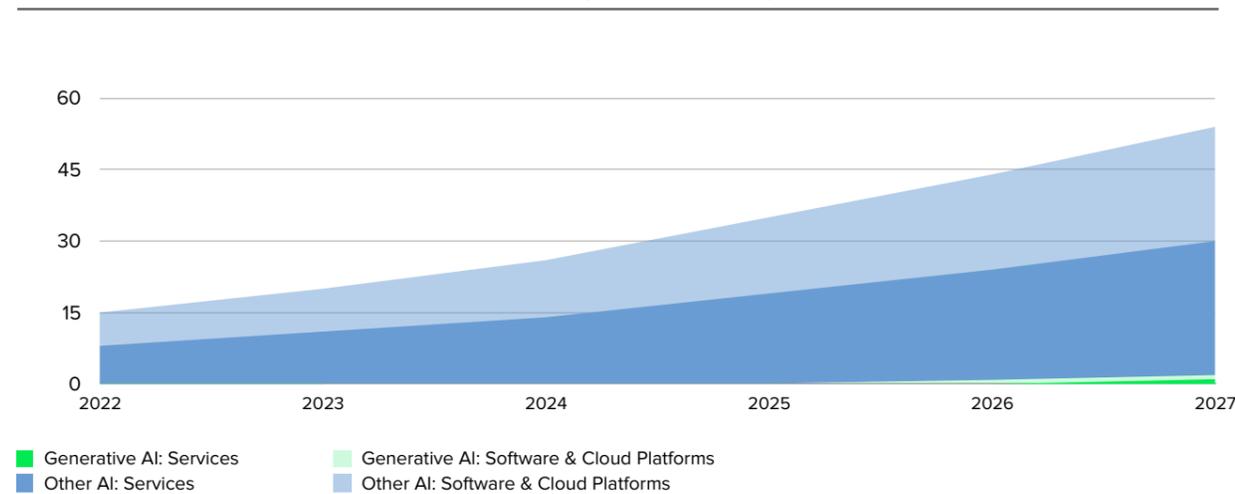


Poland: evolution 2022-2027 of total investments in AI and Generative AI (million Euros)



Poland’s market of Artificial Intelligence is expected to triple, from 60 million Euros in 2022 up to 186 million in 2027. However, the incidence of Generative AI will be limited, with a market of just 8 million Euros, almost equally split between Generative AI Services and Software & Cloud Platforms segments.

Romania: evolution 2022-2027 of total investments in AI and Generative AI (million Euros)



The Romanian ICT market is growing fast, and also Artificial Intelligence is expected to grow from 15 million Euros in 2022 to 54 million Euros in 2027. Romania is the country in the panel with the lowest incidence of Generative AI vs. total expenditure: less than 3%, with investments expected to be less than 1.5 million Euros in 2027.

PAC’s Recommendations

According to PAC analysts, the adoption of Generative AI remains at an early stage. The application of Generative AI to support image generation and speech synthesis has shown enormous progress and will be further enhanced in the coming years. Improvements in Generative AI models for text generation will provide higher-quality outputs, longer-form content, and better industry-specific tuning.

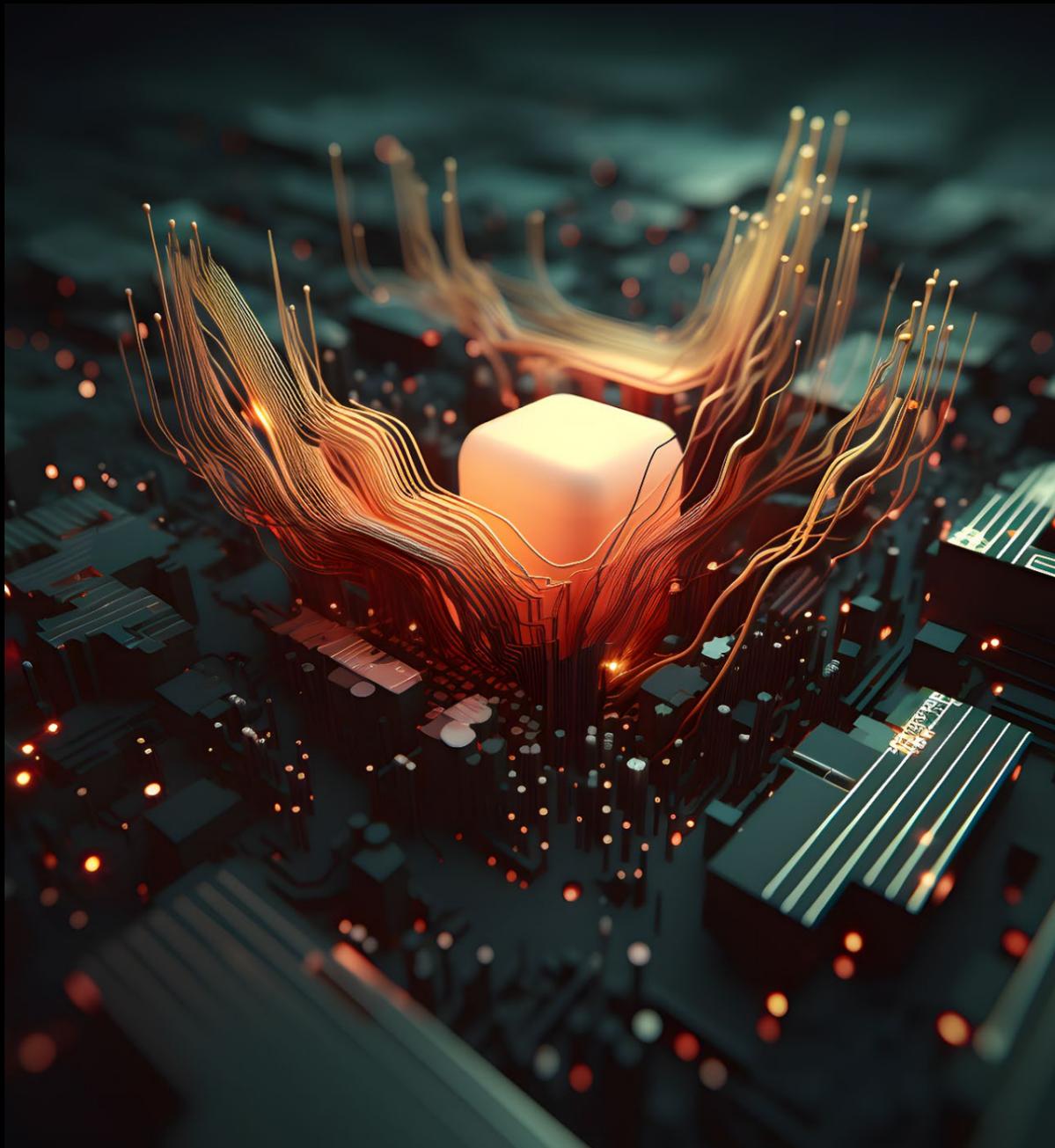
We will also see the proliferation of use cases across other industry sectors. Generative AI can enhance the use of intelligent assistants for other knowledge workers including lawyers, financial analysts and architects, helping them to reduce or eliminate time-consuming, but still important aspects of their job. In the world of law, for example, Generative AI can already automate contract drafting by automating back-and-forth interaction between legal teams on deal documents, whilst understanding the specific needs of all customers.



Generative AI projects are not much different from any other AI project, although there may be additional considerations depending on the specific use case.

- ▶ Get the right level of buy-in from the business
 - Multiple stakeholders are required to ensure that any investment supports the needs of the business. The executives that fund the initiative may not be those that ultimately benefit from the investment.
- ▶ Start with the business outcomes
 - AI projects need to start at the “output” and work their way back. Investments need to be in line with the business strategy and have a clear vision of what they want to achieve, including putting in place procedures and measures to assess the return on investment.
- ▶ Start small but think big
 - Potential challenges relating to scaling up and integration across the wider company IT ecosystem need to be considered from the outset. Select the technology building blocks that enable interoperability and agility.
- ▶ Ensure cooperation
 - Ensure cooperation between business and IT departments and that any AI solution is both technically feasible and commercially and operationally valuable. It is also vital to involve end users. This co-design approach may help to reduce resistance to working with new technologies and increase buy-in.

- ▶ Buy off-the-shelf where possible
 - As the development of AI is rather expensive, opting for an off-the-shelf solution or service may be an option for companies lacking the required resources to develop their own AI solutions.
- ▶ Pay close attention to IP issues
 - There is an ongoing debate about the intellectual property of the content generated by AI. The AI model would likely be watermarked to allow supervision of intellectual property protection. Any image generated by the model would contain an invisible signature, whose presence inside the image can be checked at a later stage for ownership verification.
- ▶ Ensure the availability and quality of the necessary data to train the models
 - As for any solutions that use vast amounts of data, companies should put in place data governance policies and strategies to ensure compliance with regulations.
- ▶ Focus on security and compliance
 - Ensure necessary security measures, as well as legal compliance (IP, GDPR) from ideation to deployment and post-market surveillance, including runtime monitoring and auditing.



Conclusions

“

“I think, for all the hype around generative AI, it is under-hyped. We’re having an App Store moment,” Gilbert said, referencing the opportunities created for startups by the 2008 launch of Apple’s marketplace for iPhone apps. “I feel like what we’re seeing right now with ChatGPT is so mind-blowing,” he added. “There’s a whole new frontier of people that are excited to build things that create value for customers on this tool.”

”

Ben Gilbert, co-founder and managing director of Pioneer Square Labs and PSL Ventures [Bishop, 2022]

The benefits are ripening and it is important to reap them

The recent release of a new class of undeniably powerful AI-powered platforms such as ChatGPT, Stable Diffusion, and Midjourney has led to a craze around the transitional power inherent in Generative AI technology for individuals, enterprises and the broader society. The genie is out of the bottle and here to stay, growing fast and faster each month.

The rise of Generative AI in recent months has unleashed a wave of excitement and curiosity about what this technology is capable of. Seemingly, as technology improves at a tremendous pace, the future of Generative AI seems closer than ever: its applications appear to be limitless, with the potential to democratise various industries. It has been rapidly put into a massive experimentation phase, with models and solutions allowing to test real-world applications and uses at scale.

Content creation is up for reinvention: from efficiency gains to real disruption, redefining creative processes and the need for future skill sets. Generative AI looks like the future of content creation, leading to significant changes in the way creatives work and content is produced. Efficiency in content generation will increase and AI-generated content will become more and more realistic and nearly impossible to distinguish from human-generated content.

In the field of knowledge workers – be it publishing, advertising, coding or design – it is already putting all realms up for reinvention. In some instances, it will create cheaper, faster and better results, and therefore replace sets of simple tasks. At the same time, it also entails a huge potential to democratise all sorts of industries.



Generative AI is set to change the relationship between technology and humans, finally living up to the promise of creating real personalised experiences for individuals. However, before embedding Generative AI in business applications at a large scale, intense testing and training of the technology on specific use cases and identifying its existing pitfalls and limitations is required.

Generative AI is pushing further into human domains, conquering the field of interactive technology with a never seen quality, impacting our lives, enterprises and the broader society at large. Enhanced AI capabilities will be infusing all sorts of everyday interactions, increasing adoption rates and training data for models and specific use cases, making Generative AI prevalent in the creation of personalised experiences.

On the Road to Artificial General Intelligence

Generative AI has the potential to transform many industries and change the way we live our lives. However, it also raises important questions about its potential long-term effects on society, the economy, and the environment. As Generative AI continues to advance, governments and organisations must consider these long-term effects and take steps to mitigate any negative consequences. This includes investing in education and training to ensure that people are equipped with the skills needed to thrive in a world where machines are generating contents, as well as developing ethical frameworks and regulations to ensure that Generative AI is used responsibly and sustainably.

All these possibilities come with caveats that require caution related to governance and regulatory matters, as Generative AI systems must overcome their drawbacks related to misinformation, copyright, and misuse. The speed at which Generative AI is

developing presents a challenge for regulatory bodies, that must ensure the models are safe. The involvement of international authorities will guarantee better enterprise-level compliance with these tools.

“ **Gartner expects that by 2026, organizations that operationalize AI transparency, trust and security will see their AI models achieve a 50% result improvement in terms of adoption, business goals and user acceptance. Gartner also predicts that by 2028, AI-driven machines will account for 20% of the global workforce and 40% of all economic productivity.** ”

[Gartner, 2022]

While Generative AI is becoming a game-changer for many industries, it is also an essential step towards achieving General AI, also known as Artificial General Intelligence (AGI). General AI is the next level of AI development, where machines are capable of performing any intellectual task that a human can do. This includes things like reasoning, problem-solving, learning, and decision-making.

Generative AI models use a technique called unsupervised learning, which means that they can learn from unlabelled data without human intervention. This approach allows machines to generate data that is similar to the input data without being explicitly taught what it represents. This capability is essential for General AI, as it enables machines to learn and adapt to new situations without relying on pre-programmed rules or algorithms.

While there are still many challenges to overcome, the progress made in Generative AI has opened up new possibilities for AI applications, as well as providing vital insights into how human intelligence works. The development of General AI is the



ultimate goal for many researchers and developers. However, it is a complex and challenging task that requires significant breakthroughs in various fields, such as computer vision, natural language processing, and robotics.

Generative AI is an essential step towards achieving Artificial General Intelligence, as it provides machines with the ability to generate new data and adapt to new and evolving situations. Reaching General AI does not have to be seen as a scary prelude to technological singularity but rather as a great and rapidly growing opportunity to make everyday personal and corporate lives easier and more productive.

APPENDIX

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